

## POWER FACTOR CONTROLLER

## ■ GENERAL DESCRIPTION

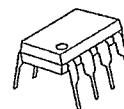
The NJM2375/A are active power factor controllers, which limit the harmonic current resulting from the power supply block of electrical devices.

They include a startup timer, an one quadrant multiplier, a zero current detector to ensure critical condition operation, a transconductance error amplifier, high precision reference, a current sensing comparator, and a totem pole output ideally suited for driving a power MOSFET.

They also contain protection circuits for overvoltage, cycle-by-cycle overcurrent, and maximum peak current.

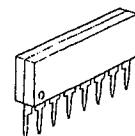
The startup threshold of NJM2375A is lower than that of NJM2375.

## ■ PACKAGE OUTLINE



NJM2375D/AD

NJM2375M/AM



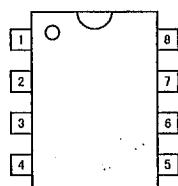
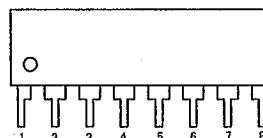
NJM2375V/AV

NJM2375L/AL

## ■ FEATURES

- Overvoltage Comparator Eliminates Runaway Output Voltage
- Internal Quick Start
- Internal Startup Timer
- One Quadrant Multiplier
- Zero Current Detector
- High Precision Reference ( $\pm 2\%$ )
- Totem Pole Output with High State Clamp
- Undervoltage Lockout  
(Startup Threshold/NJM2375:13V typ., NJM2375A:10.4V typ.)
- Low Startup and Operating Current
- Bipolar Technology
- Package Outline DIP8, DMP8, SSOP14, SIP8

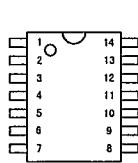
## ■ PIN CONFIGURATION

NJM2375D/AD  
NJM2375M/AM

NJM2375L/AL

## PIN FUNCTION

1.  $V_{FB}$
2.  $C_{OMP}$
3.  $MULT$
4.  $C_{SENSE}$
5.  $D_{ZERO}$
6.  $GND$
7.  $DRIVE$
8.  $V^+$

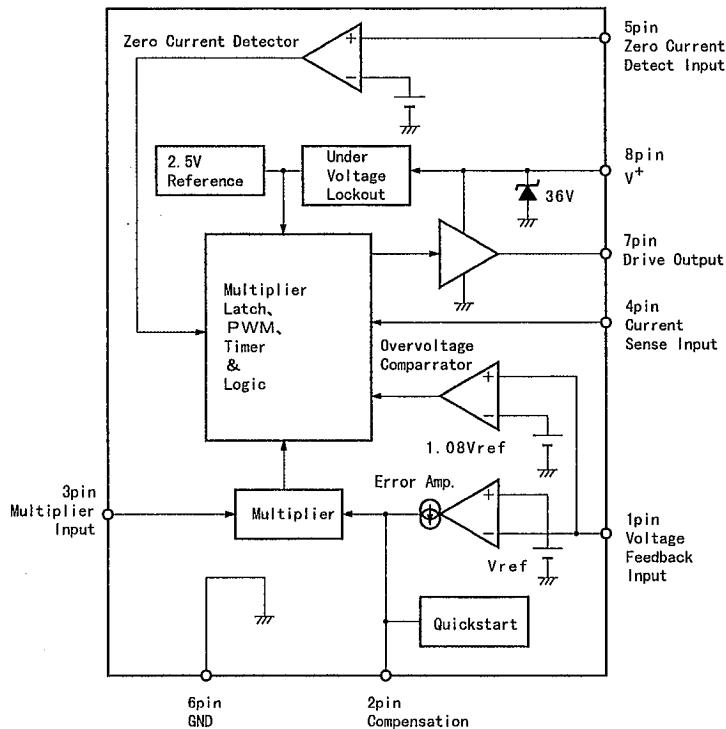


NJM2375V/AV

## PIN FUNCTION

1.  $MULT$
2.  $NC$
3.  $C_{SENSE}$
4.  $NC$
5.  $D_{ZERO}$
6.  $NC$
7.  $GND$
8.  $DRIVE$
9.  $NC$
10.  $V^+$
11.  $NC$
12.  $V_{FB}$
13.  $NC$
14.  $C_{OMP}$

## ■ BLOCK DIAGRAM



#### ■ ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Total Power Supply and Zener Current	$I_{CC} + I_Z$	30	mA
Output Current (Source or Sink)	$I_O$	500	mA
Current Sense, Multiplier, and Voltage Feedback Inputs	$V_{IN}$	-1.0 ~ +10	V
Zero Current Detect Input			
High State Forward Current	$I_{IN}$	50	mA
Low State Forward Current		-10	
Power Dissipation	$P_D$	(DIP8) 500 (DMP8) 300 (SSOP14) 300 (SIP8) 700	mW
Operating Temperature Range	$T_{OPR}$	-40 ~ +85	°C
Storage Temperature Range	$T_{STO}$	-50 ~ +150	°C

■ ELECTRICAL CHARACTERISTICS ( $V^+=12V^{*1}$ ,  $T_a=25^\circ C$ )

## ● ERROR AMPLIFIER

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Voltage Feedback input Threshold 1	$V_{FB1}$	$V^+=12V$	2.465	2.500	2.535	V
Voltage Feedback input Threshold 2	$V_{FB2}$	$V^+=28V$	2.440	2.500	2.540	V
Line Regulation	RegLine	$V^+=12\sim28V$	—	1.0	10	mV
Input Bias Current	$I_{IB}$	$V_{FB}=0V$	—	-0.1	-0.5	$\mu A$
Transconductance	$g_m$	—	80	100	130	$\mu mho$
Output Current (Source)	$I_{OS0}$	$V_{FB}=2.3V$	—	10	—	$\mu A$
Output Current (Sink)	$I_{OS1}$	$V_{FB}=2.7V$	—	10	—	$\mu A$
Output Voltage Swing 1	$V_{OH(\infty)}$	$V_{FB}=2.3V$ (High State)	5.8	6.4	—	V
Output Voltage Swing 2	$V_{OL(\infty)}$	$V_{FB}=2.7V$ (Low State)	—	1.7	2.4	V

## ● OVERVOLTAGE COMPARATOR

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Voltage Feedback Input Threshold	$V_{FB(OV)}$	—	1.065 $\times V_{FB}$	1.080 $\times V_{FB}$	1.095 $\times V_{FB}$	V

## ● MULTIPLIER

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Bias Current	$I_{IB}$	$V_{FB}=0V$ (FB Pin)	—	-0.1	-0.5	$\mu A$
Input Threshold	$V_{th(M)}$	(FB Pin)	1.05 $V_{OL}$ $\times (EA)$	1.20 $V_{OL}$ $\times (EA)$	—	V
Dynamic Input Voltage Range	$V_{PIN3}$ $V_{PIN2}$	Multiplier Input Pin Compensation Pin	0~2.5 $V_{th(M)}$ ~ $V_{th(M)}$ +1.0V	0~3.5 $V_{th(M)}$ ~ $V_{th(M)}$ +1.5V	—	V
Multiplier Gain <sup>*2</sup>	K	$V_{mp}=0.5V$ , $V_{comp}=V_{th(M)}+1.0V$	0.43	0.65	0.87	$\mu mho$

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## ● ZERO CURRENT DETECTOR

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Threshold Voltage	$V_{th}$	$V^+$ Increasing	1.33	1.60	1.87	V
Hysteresis	$V_H$	$V^+$ Decreasing	100	200	300	mV
Input Clamp Voltage	$V_{IH}$	High State ( $I_{DET}=+3.0mA$ )	5.20	5.80	—	V
	$V_{IL}$	Low State ( $I_{DET}=-3.0mA$ )	0.30	0.70	1.00	V

## ■ ELECTRICAL CHARACTERISTICS (V<sup>+</sup>=12V<sup>\*1</sup>, Ta=25°C)

### ● CURRENT SENSING COMPARATOR

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Bias Current	I <sub>IB</sub>	I <sub>sense</sub> =0V	—	-0.15	-1.0	μ A
Input Offset Voltage	V <sub>IO</sub>	V <sub>compo</sub> =1.10V, V <sub>M</sub> =0V	—	9.0	25.0	mV
Maximum Current Sense	V <sub>th (MAX)</sub>		1.30	1.50	1.80	V
Input Threshold <sup>*3</sup>			—	200	—	nS
Delay to Output	t <sub>PHL</sub>		—			

### ● DRIVE OUTPUT

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage Low State	V <sub>OL1</sub> V <sub>OL2</sub>	I <sub>sink</sub> =20mA I <sub>sink</sub> =200mA	— —	0.3 2.4	0.8 3.3	V
Output Voltage High State	V <sub>OH1</sub> V <sub>OH2</sub>	I <sub>source</sub> =20mA I <sub>source</sub> =200mA	9.8 7.8	10.3 8.4	— —	V
Output Voltage High State	V <sub>C (MAX)</sub>	I <sub>source</sub> =20mA CL=15pF, V <sup>+</sup> =30V	14	16	18	V
Output Voltage Rise Time	t <sub>r</sub>	CL=1.0nF	—	100	150	nS
Output Voltage Fall Time	t <sub>f</sub>	CL=1.0nF	—	50	120	nS
Output Voltage with UVLO Activated	V <sub>C (UVLO)</sub>	V <sup>+</sup> =7V, I <sub>sink</sub> =1.0mA	—	0.1	0.5	V

### ● RESTART TIMER

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Restart Time Delay	t <sub>DLY</sub>		200	620	—	μS

■ ELECTRICAL CHARACTERISTICS ( $V^+=12V^{*1}$ ,  $T_a=25^\circ C$ )

## ● UNDERVOLTAGE LOCKOUT

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
(NJM2375)						
Startup Threshold	$V_{th(on)}$	$V^+$ Increasing	11.5	13.0	14.5	V
Minimum Operating Voltage After Turn-On Hysteresis	$V_{shutdown}$	$V^+$ Decreasing	7.0	8.0	9.0	V
	$V_H$		3.8	5.0	6.2	V
(NJM2375A)						
Startup Threshold	$V_{th(on)}$	$V^+$ Increasing	9.4	10.4	11.4	V
Minimum Operating Voltage After Turn-On Hysteresis	$V_{shutdown}$	$V^+$ Decreasing	6.8	7.8	8.8	V
	$V_H$		1.4	2.6	3.8	V

## ● TOTAL DEVICE

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Power Supply Current Startup	$I_{cc1}$	$V^+=7.0V$	—	0.25	0.4	mA
Operating	$I_{cc2}$		—	6.5	12	mA
Dynamic Operating Power Supply	$I_{cc3}$	50kHz, $CL=1.0nF$	—	9.0	20	mA
Zener Voltage <sup>*4</sup>	$V_z$	$I_{cc}=25mA$	30	36	—	V

## ● NOTES

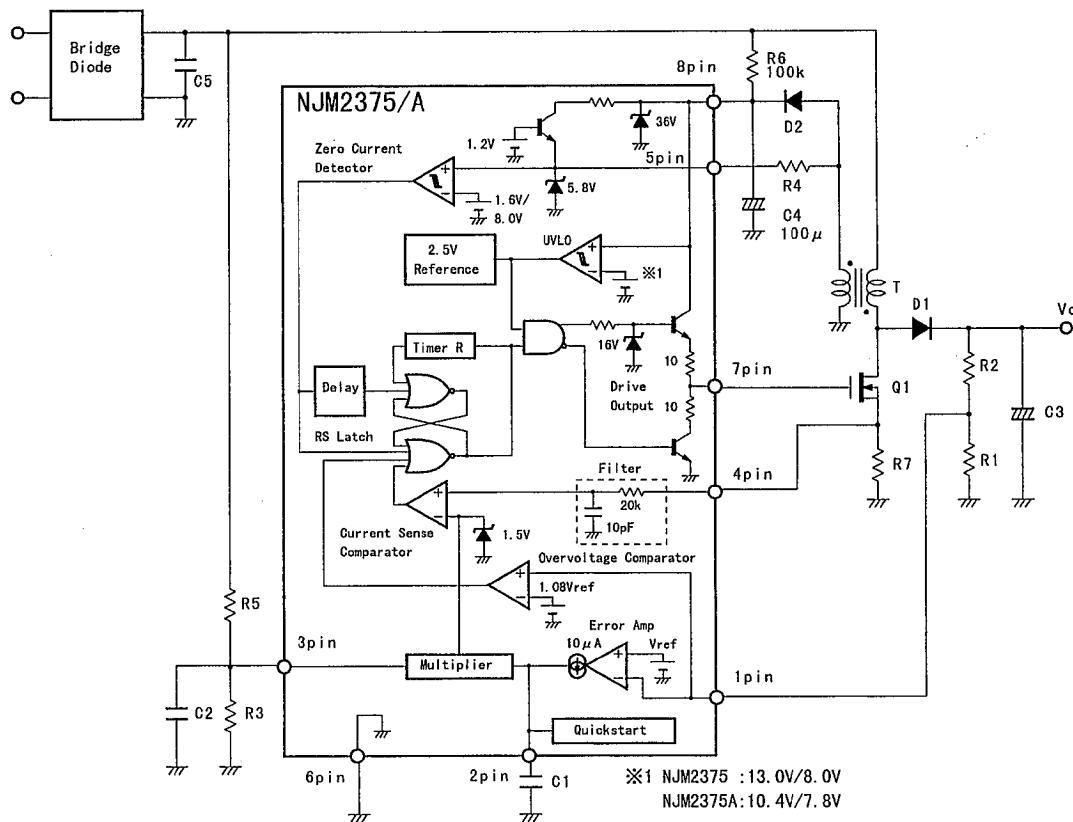
※1 : Adjust  $V^+$  above the startup threshold before setting to 12V.

$$\text{※2 : } K = \frac{V_{th(\text{max})}}{V_M \times (V_{comp} - V_{th(M)})}$$

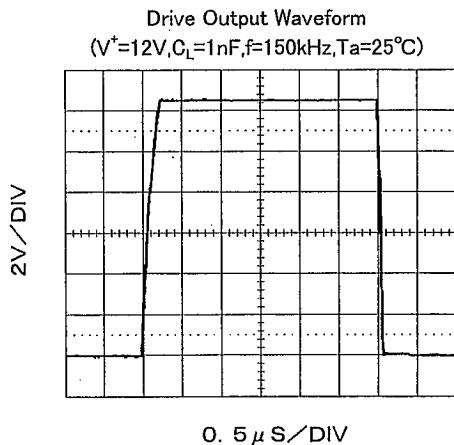
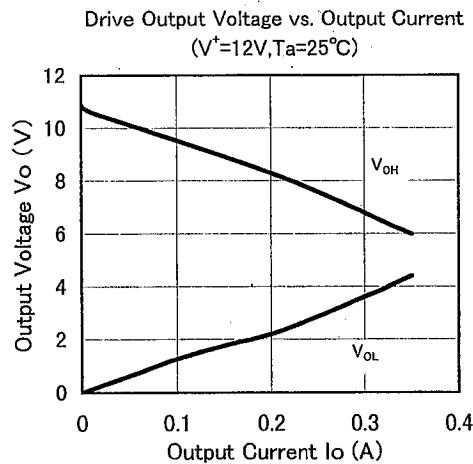
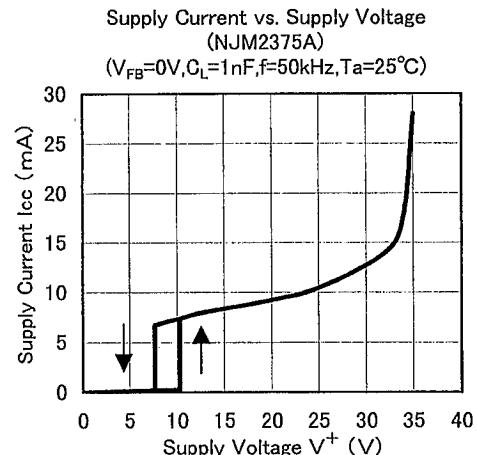
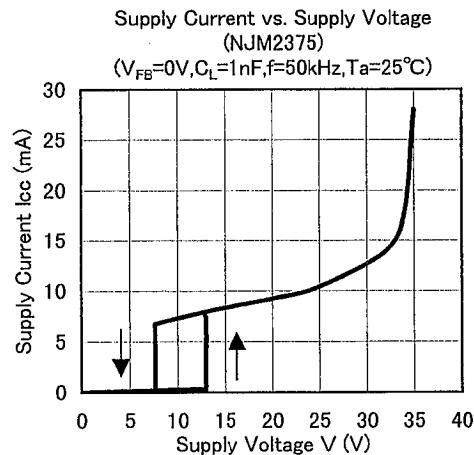
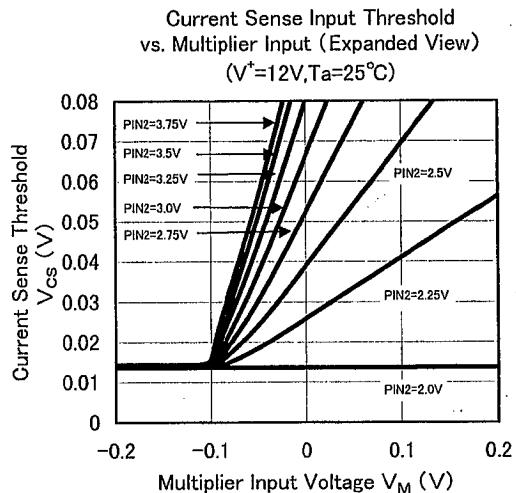
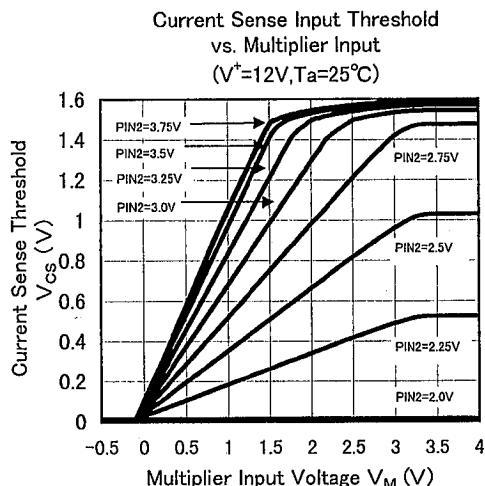
※3 : This parameter is measured with  $V_{FB}=0V$ , and  $V_M=3.0V$ .

※4 : Do not supply higher voltage above the zener voltage to 8pin, because the internal zener diode protects the IC from surge.

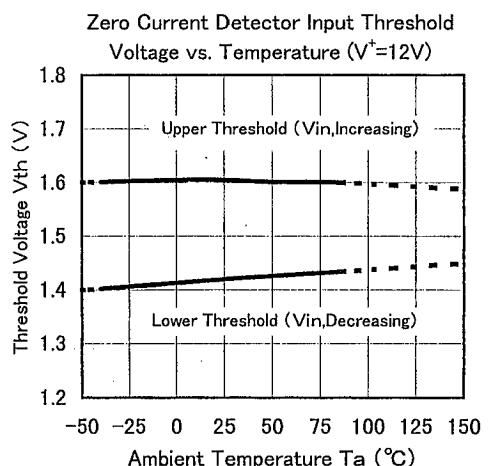
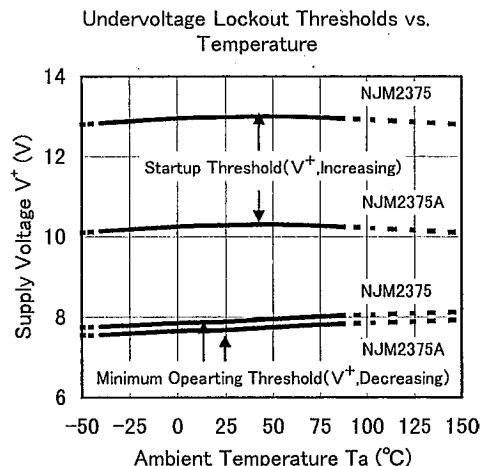
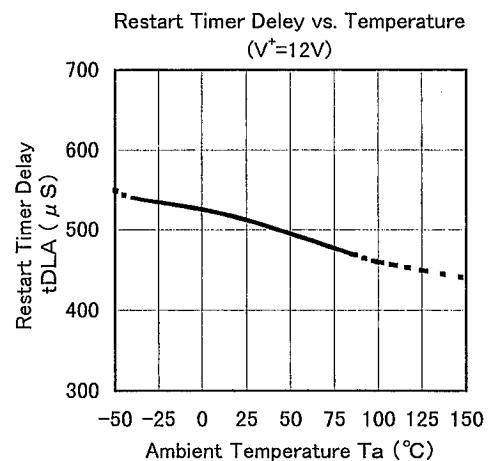
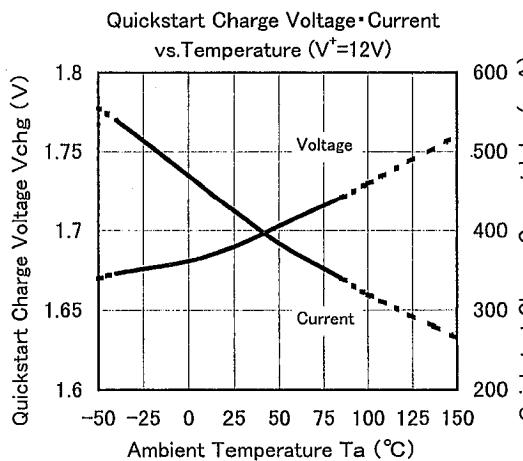
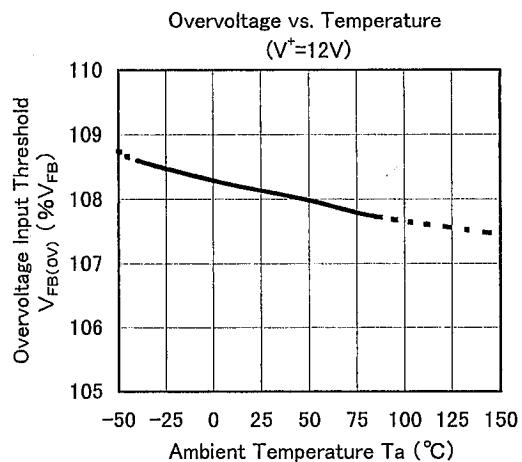
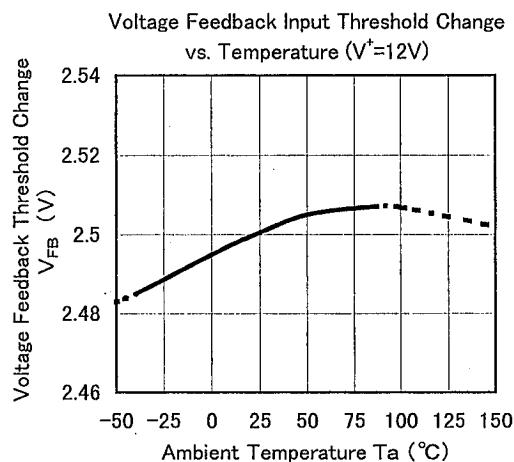
## ■ TYPICAL APPLICATIONS



## ■ TYPICAL CHARACTERISTICS



## ■ TYPICAL CHARACTERISTICS



## MEMO

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